CHARACTERIZATION AND RISK ASSESSMENT OF ATMOSPHERIC POLLUTANTS IN KLANG VALLEY,MALAYSIA(Digest_要約)

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論文題目	CHARACTERIZATION AND RISK ASSESSMENT OF ATMOSPHERIC POLLUTANTS IN KLANG VALLEY, MALAYSIA （マレーシア、クラン渓谷における、大気汚染物質の特性評価およびリスクアセスメント）		

（論文内容の要旨）

This thesis presents the results of the first synthetic survey of the situation of air quality and its health risk level in Klang Valley in Malaysia, and consists of nine chapters.

Chapter 1 Introduction provides information on background information of air quality in Malaysia and specifically addressing the condition in Klang Valley. In addition, the aim, objectives and rationale of the study were also determined.

Chapter 2 Literature review covered three main sub-chapters which included the atmospheric aerosols, trace elements and PAHs. The first sub-chapter covered the general characteristics and health effects of atmospheric aerosols. The second sub-chapter covered the details related to trace elements; including the source and movement of trace elements in the environment, the use of metals in various activities and also metal deposition and toxicity. Consequently, the next sub-chapter provided information related to PAHs; including the physical and chemical characteristic, toxicity, carcinogenicity, sources, chemical transformation and deposition of PAHs.

Chapter 3 This chapter highlights the concentrations and size distributions of trace elements Ag, Cd, Co, Cr, Cu, Li, Mn, Ni, Pb and Sr in atmospheric PM. The 24-h TSP levels in Petaling Jaya in haze situation were higher compared to Bangi in non-haze situation with the concentrations of 79.48μg/m^3 and 22.66μg/m^3; respectively. In addition, particles smaller than 0.49μm diameter contribute more than 50% of total PM concentrations in both locations; which is 68% in Bangi and 55% in Petaling Jaya. Among the trace metals that were studied, Cr in Bangi and Sr in Petaling Jaya have recorded an outstanding higher concentrations than other trace elements in their groups, in all particle sizes; except for Sr in Petaling Jaya for particle size less than 0.49μm. Cr in Bangi and Sr in Petaling Jaya recorded the highest concentrations for particle sizes less than 0.49μm and 0.49-0.95μm; respectively. In the coarse mode aerosols, high concentrations of Cr (21.88ng/m^3) and Sr (10.96ng/m^3) were found in Bangi. On top of that, the chemical composition of coarse PM is found to have higher concentration of Sr (18.74ng/m^3), Mn (8.58ng/m^3), Cu (7.94ng/m^3) and Cr (6.34ng/m^3) than other elements in Petaling Jaya. In the case of fine PM, the Cr, Sr and Cu showed higher concentration in Bangi with the reading of 32.49ng/m^3, 8.46ng/m^3 and 7.75ng/m^3; respectively. Meanwhile in Petaling Jaya, the results indicate the abundance of Sr, Cu, and Cr with the recorded concentration 18.05ng/m^3, 12.27ng/m^3 and 8.31ng/m^3; accordingly.

Chapter 4. Result sources of characterization study showed that the trace elements were believed to be originated from vehicles emission/oil combustion, re-suspended dust/brake emission and industry emission. The non-carcinogenic risk assessment in terms of Hazard Quotient (HQ) and Hazard Index (HI) were calculated according to exposure to particulate bound metals. Based on the result, it was found that inhalation is an important pathway of exposure for trace elements in the circumstance of particulate matter in Bangi and Petaling Jaya. For both sampling location Bangi and Petaling Jaya, the same trend of results was observed. Inhalation of particles appeared to have much higher risk for Cr, Co and Mn, which were one to three orders of magnitude higher than the corresponding risks of the dermal exposure route. Regarding non-cancer effects, all trace elements exhibit Hazard Index lower than safe level (1). In this study, the incremental lifetime cancer risk (ILTCR) from the exposure of ambient atmospheric particulate matter for Cr, Pb, Cd, Ni, and Co was calculated. Cr had the highest ILTCR values among all the carcinogens. In Bangi, the estimate Cr risk values for adult were 3.50E-05 (coarse mode) and 5.19E-05

(fine mode); while for children the values were 1.26E-05 (coarse mode) and 1.87E-05 (fine mode). Similarly, the Cr ILTCR values in Petaling Jaya for adult were 1.01E-05 (coarse mode) and 1.33E-05 (fine mode); as for the children were 3.65E-06 (coarse mode) and 4.78E-06 (fine mode).

Chapter 5 This chapter determined the types of trace elements found in the analysis of whole blood samples using the Total Reflection X-Ray Fluorescence (TXRF). Generally, all the trace elements detected in this study were lower in concentration compared to the concentration from the literature value. The results were consistent with other researcher that indicated the nutritional level of elements Zn, Cu, Fe, Ca and K were in lower concentration compared to non-pregnant women. Based on the result, It can be said that exposure of pregnant women in Kuala Lumpur from environmental pollutants still in the safe limit.

Chapter 6 This chapter presented the composition and profiles of PAHs components in atmospheric PM. Comparison of PAHs distributions in atmospheric particles based on number of aromatic rings and carcinogenic and non-carcinogenic compounds PAHs were shown in this chapter. The average ΣPAHs concentrations for June and July were recorded at 1.63ng/m^3 and 0.99ng/m^3; respectively. According to present study, it was indicated that six ringed PAHs were predominantly observed followed by five and four ringed forms respectively. In June, 52 % of PAHs were six ringed, followed by 34% five ringed and 14% of four ringed. Similar trend was observed in July where 56% were six ringed, followed by 40% five ringed and 4% of four ringed. The result also indicated that 61% of the total PAHs found in this study area for June and July were carcinogenic PAHs whereas 39% are non-carcinogenic PAHs.

Chapter 7. Diagnostic ratio study, concluded that the mixture of petrogenic origin, vehicles emission and biomass burning acted as the main sources of PAHs in Bangi ambient atmospheric PM. Using a Inhalation Cancer Unit Risk Factor of Benzo(a)Pyrene (UR_{BaP}) value of 1.1×10^{-6} per ng/m^3, the estimated cancer risk for a lifetime of 70 years is 0.32 and 0.26 cancer cases per million people in June and July; accordingly. Alternatively, by using a UR_{BaP} value of 8.7×10^{-5} per ng/m^3, the inhalation cancer was 25 and 20 cancer cases per million people in June and July; accordingly. However, all the values were still in safe limit of health guidelines. Dermal contact exposure route was one of the major contributor lifetime cancer risks in Bangi as indicated by the high ILTCR with the cancer cases between 1.6-3.1 cancer cases per million people values found in this study.

Chapter 8 This chapter was comprised of topic related to determination of benzo(a)pyrene diol epoxide (BPDE) adducts in human plasma exposed to PAHs. In this study, the OxiSelect BPDE Protein Adduct ELISA kit was used as enzyme immunoassay for rapid detection of BPDE protein adducts. The concentrations of benzo(a)pyrene-diol-epoxides with human serum albumin (BPDE-HSA) adducts found in this study were relatively small compared to the reported value from other studies

Chapter 9 The conclusion briefly summarizes the main findings of the study and what can be concluded from them. In addition, recommendations for improvements and references to future research were also given.